3.E.2.e (4) (cont'd) It is important to know how the Coast Guard may adopt or modify these provisions. When are superheaters, economizers, or unfired steam generators designed in accordance with Section I, and when must they meet the requirements of Section VIII? Must a 25 psig heating boiler meet Section I or Section IV? Which steam piping must meet Section I, and which piping must meet 46 CFR 56? The answers to questions such as these must be clearly understood by Coast Guard marine safety personnel.

f. Thermal Fluid Heaters (TFHs).

(1) Introduction. TFHs are being used increasingly in marine applications, both in this country and overseas. Although these heaters may be either fired or unfired, fired heaters are by far the most common. There are many possible applications for thermal fluid heaters for heating, heat recovery, or cooling. These units may be used to maintain the temperature of heavy fuel, preheat lube oil or cooling water, space heating, unfired steam generation, tank washing heat exchangers, cargo pipe tracing, and other applications. The most common application with which Coast Guard personnel are involved is the heating of petroleum products or other chemicals carried as cargo on ships or barges. Many of these cargoes must be heated to maintain pumpability. Fires in connection with TFHs are a very real potential hazard. Most heat transfer fluids are combustible and are, of course, heated during TFH operation. Fuel is being pumped to the burners. Flames, hot surfaces, and electrical sources of ignition may all be present. Therefore, one should not underestimate the potential hazard of these units just because associated pressures may be low and steam is not being generated. It is recommended that special attention be given during inspections to operational testing and visual checks of piping, pipe connections, and mountings. Operating manuals approved for fired TFHs should include a detailed test procedure for controls, alarms, and shutdowns.

(2) Adherence to 46 CFR Parts 52 and 63. Table 54.01-5(a) shows that the requirements of 46 CFR 52 and 63 are applicable. Essentially, this is saying the heater will be constructed per ASME Code, Section I, and have controls, alarms, and shutdowns similar to those required for auxiliary boilers. In fired TFHs, forced circulation with a continuous positive control of fluid in each heating coil or tube is very important. In a "firetube" type of heater, it would not be possible to adequately control fluid velocity throughout the heater. The usual watertube boiler type design also inadequately controls heat flux rates throughout a fired TFH. The most popular shipboard design today employs a limited number of watertube coils to control circulation (sometimes only one coil is used). The smaller units may use only radiant heating, with larger units also having a convective section. Fluid velocities that are too low will result in high film temperatures and decomposition of the fluid. No phase change in the fluid should occur in a TFH, or upon leakage from the system. The coil design usually will not accommodate the installation of soot blowers, making manual cleaning necessary while the heaters are shut down. Expansion tanks should be mounted high enough in the system to provide a positive head to

3.E.2.f

(2) (cont'd) prevent the ingress of cargo or other heated liquid if a tank coil or heat exchanger should fail. These tanks are left uninsulated to avoid heat buildup and fluid oxidation.

(3) Requirements for Fired TFHs. Fired TFHs must not be installed in hazardous locations. Heater fuel systems must comply with 46 CFR 56 requirements for fuel piping. Hot surfaces must be insulated as required by 46 CFR 56.50-1(k) to prevent injury to personnel. Relief valves must be installed to protect the heater in event of clogging or inadvertent valve closure. These valves normally relieve to the expansion tank. In the past, the Coast Guard has considered the flash point of the heat transfer fluid to be the practical safe limit of operating temperature for TFHs, and the high temperature cut-off settings are approved accordingly. A leak into a space is considered less hazardous in the form of a combustible liquid than as a potentially explosive cloud of vapor.

Simple heaters with non-corrosive fluids generally warrant less attention during operation and less maintenance on the heater proper than do steam units. However, the controls, alarms, and shutdowns should be regularly tested and maintained. Controls, alarms, and shutdowns for fired TFHs are similar to those required for boilers. Burner control can be on/off, high/low/off, or fully modulating, depending on type of fuel and heater size. Burner sequences are controlled by a timer, which is programmed to check the operation of controls and safety devices while monitoring the flame by photo-electric or ultraviolet sensing. Fluid temperatures are usually controlled by thermostats, with sensing elements typically installed at the inlet header and the outlet of each coil. Fluid flow, fluid level, and temperature measuring devices automatically shut down the burner under abnormal conditions. Requirements for controls and shutdowns are detailed in 46 CFR 63.

(4) Use of Heat Transfer Fluids. Most of the heat transfer fluids used today are mineral oils or synthetic hydrocarbons. Isomers and diphenyl-diphenyl oxide are also occasionally used. Other types of fluids are available for special applications. What makes these fluids better than steam for heating purposes? First, the economy and safety of a low pressure system can be realized, since the temperature is not pressure-dependent as in the case of steam. Lower pressure also decreases leakage potential and the possibility of contaminating the product being heated. Many chemicals that would react strongly with water are more compatible with heat transfer fluids. Thermal fluids may be pumped at low temperatures, and have no condensate return lines to freeze. Feed water treatment is eliminated. Internal scaling and corrosion are greatly reduced. These fluids do not form a vacuum in the system after shutdown, which would tend to contaminate the fluid. Despite these features, there are some problems with heat transfer fluids that should be understood:

(a) The fluids are combustible, requiring equipment and procedures to minimize fire risk. They also constitute a potential water pollutant.